

# B R E V I O R A

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### NOTES ON HISPANIOLAN HERPETOLOGY

#### 2. A REVIEW OF THE *ANOLIS SEMILINEATUS* GROUP WITH THE DESCRIPTION OF *ANOLIS COCHRANAE*, NEW SPECIES

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INTRODUCTION: Recent investigations in Haiti and the Dominican Republic by expeditions from the Museum of Comparative Zoology have added considerably to our knowledge of the distribution of the so-called grass-anoles of the *semilineatus* group and have resulted in the discovery of a third member of the series in the Cordillera Central of the Dominican Republic. In addition to describing the new species just discovered we here attempt a summary of the information now available on this group.

ACKNOWLEDGMENTS: The new species was collected in the summer of 1958 by Clayton E. Ray and A. Stanley Rand during an expedition partly supported by a grant from the Society of Sigma Xi and enjoying the cooperation of the University of Santo Domingo and of the government of the Dominican Republic. The essential and generous aid of Dr. Eugenio de Jesus Marceno, who accompanied the expedition, and the use of a car and driver furnished by the University of Santo Domingo are very gratefully acknowledged. In August 1959, E. E. Williams and A. S. Rand collected in the vicinity of Port-au-Prince with the support of National Science Foundation Grant NSF G-5634. In 1960 A. S. Rand and J. Lazell collected around Port-au-Prince in northern Haiti and near Aux Cayes on the southwest peninsula, aided by a grant from the American Philosophical Society. In both Haitian trips the letters provided by M. Gerard Philippeaux, Minister of Agriculture, and the willing assistance of M. Leonce Bonnefil fils, zoologist in the Department

of Agriculture and Natural Resources, were indispensable elements in the success of the venture.

In addition to the specimens collected by these expeditions and those already present in the Museum of Comparative Zoology (MCZ), material was obtained on loan from the United States National Museum (USNM) and the American Museum of Natural History (AMNH). The assistance of the curators of these collections is gratefully acknowledged. Dr. P. S. Humphrey made available for study material collected by him for Yale Peabody Museum (Yale) and the University of Florida (UF).

**THE PREVIOUSLY KNOWN SPECIES:** In order to provide a frame of reference for the new species, we first summarize the knowledge now at hand for the previously known species: Two species of "grass anoles," *A. semilineatus* Cope and *A. olssoni* Schmidt, have long been known in Hispaniola. Both are small (ca. 40 mm snout-vent length), slender-bodied forms with elongate heads, a dorsal zone of about 10 rows of enlarged keeled scales as large as the strongly keeled belly scales, tail only slightly compressed and with no clear demarcation of the breaking zones or verticils. They are thus a morphologically strongly marked group within the Hispaniolan anoles. In habits they are also distinctive, being associated characteristically with grass and low bushes.

**MORPHOLOGY:** (See also table, below). Structurally the two species differ very little—they differ in size of scales and slightly in body size, tail length and shape of head but in none of these regards so strikingly that instant identification can be confidently made even by the experienced worker. Body coloration differs also but not without some puzzling cases. The dewlap in males, both as to color and squamation, is the diagnostic difference easiest to employ. The dewlap skin in *A. semilineatus* is white and the gular scales about the same size as the ventrals. In *olssoni* the dewlap skin is red or orange (darkly pigmented in alcohol) and the gular scales up to three times as large as the ventrals. In life the iris of *semilineatus* is steel blue, that of *olssoni* dark brown. This difference is not determinable in alcoholics.

**ECOLOGY:** There exists a real ecological difference between the two species but again there is overlap and the species do occur side by side.

Mertens (1939) describes *A. semilineatus* as "eurytop" occurring in both dry and wet areas. He found it in mangroves (Puerto Plata, Sabana de la Mar), corn fields (Moca), dry open brush (Barahona, San Pedro de Macoris, Ciudad Trujillo), meadows

in the lower drier pine woods (Jarabacoa, Moncion), and in damp lush vegetation (Samana, the top of the pass between Santiago and Puerto Plata). He, in fact, states that it is absent only in the cactus-steppe. Rand (1958, field observations) saw it in the Dominican Republic primarily in open situations and along roadsides and in pastures but found also a single specimen sitting on a rock in a muddy trail through heavy forest (Bejucal), and a dense population living in low vegetation in an area of rather dense bamboo along a stream bank (nr. Sabana de la Mar). Hassler (field notes for November 4, 1929) reports finding this species at Laguna near Samana on "leaves in damp woods and in fields nearby."

Near Port-au-Prince, *scmilineatus* occurs in the hills to the south of town and up to the vicinity of Furey at 4000-5000 ft. It is absent from Port-au-Prince itself and from the Cul de Sac Plain. In one place it has been observed to overlap with *olssoni* (see below).

Mertens has described *A. olssoni* in contrast to *A. scmilineatus* as "stenotop," confined to open dry areas. It seems, indeed, to be more limited than *scmilineatus*, but in 1959 Williams and Rand found it in the moderately dense vegetation of a Port-au-Prince garden and also in the irrigated areas of the experimental farm at Damien, Haiti. It is present in open thorn scrub of the Cul-de-Sac Plain both in Haiti and in the Dominican Republic. It is known to occur with *scmilineatus* at several localities. Mertens records both forms from the vicinity of Ciudad Trujillo, and at Moncion, Sabana de la Mar and Barahona, all localities in the Dominican Republic. Cochran reports both species at San Michel du Nord, Haiti. In 1960 Rand and Lazell obtained both species at Gros Morne in northern Haiti. They found "*A. olssoni* on grass and low vegetation along sunny roadsides, *A. scmilineatus* on vegetation at the edge of forest."

In August 1959 Williams and Rand studied a contact area between *scmilineatus* and *olssoni* on Bontillier Road which climbs the foothills south of Port-au-Prince. *A. olssoni* occurred only on the lower reaches of the road, *A. scmilineatus* only on the portion of the road which parallels the crest of the hill. No striking vegetation or habitat difference was evident between the two portions of the road, both of which traverse very disturbed, cut over, areas. The distance between the places at which *scmilineatus* and *olssoni* were found closest to one another was a matter of a few vertical yards. Rand and Lazell returning

to the same area in 1960 found the same general pattern but in one instance a *semilineatus* was taken about 20 feet from an *olssoni* and at the same level.

**HABITS:** The two species differ very little in habits. Both are commonly seen on grass stems and the slender twigs of small bushes and plants. Sometimes they occur on fence posts and stands of barbed wire and occasionally on the ground. None have been seen on the trunks or in the crown of even small trees. Numbers of *A. olssoni* were observed by Williams and Rand at Damien, Haiti. Individuals of all sizes were found in the tall grass, while on the fence posts most of the animals were large males, and in the short 4-8 inch grass most were juveniles. They are frequently found facing head downward on a vertical perch with the neck bent so that the head is almost horizontal. Both sleep with the hind legs fully extended. Both escape by jumping off their perch into grass cover nearby. In one area near Port-au-Prince a few individuals were chased out of the grass into a rock pile. Here they did not go deep into the rock pile in contrast to juvenile *A. cybotes* but hid close to the surface and could usually be chased out by poking into the holes with a short stick. *A. semilineatus* is perhaps shier than *A. olssoni* and, according to Mertens, it is less pugnacious. Mertens reports that freshly caught *olssoni* carried out biting battles with each other, raising the nuchal crest and displaying their dewlaps.

Very little is known of the reproductive habits of these forms. There is one observation by Rand (field notes, 1958) on *A. semilineatus* in the Dominican Republic: "In one locality (Rancho La Guardia, San Rafael Province) in a coffee plantation about twenty yards from open pasture, a number of eggs of this species were found. These were discovered in three of 22 rotten logs examined in a small area. One log contained 12 eggs, another 7 eggs, and the third 4 eggs. These three logs differed from the others examined in that they contained nests of a large black stinging ant. The eggs were mostly in the loose soil just under the logs but some were in the galleries of the ant nest. When I picked up the first egg an ant stung me and my involuntary jump sent the egg flying several feet. The other logs in the area contained a variety of invertebrate life but the ones with the lizard eggs had only the black ants and a single centipede nest. The ants provided an effective protection for the lizard eggs and it seems possible that the lizards had sought out these nests in which to lay their eggs.

The eggs were ovoid with a white flexible skin. They ranged in size from 12 by 9 mm to 7 by 6 mm. Collected on August 13 fourteen of the twenty-two eggs hatched, the first on August 15 and the last on September 17."

**DISTRIBUTION:** Both species are very widely dispersed in Hispaniola. Because of their ecological differences the two distributions coincide only in limited and scattered areas, though in broad terms they overlap widely. No *olssoni* are at present known from the Samana peninsula and the adjacent areas in the north of the Dominican Republic north of La Vega and east of Puerto Plata, or from the southwestern peninsula of Haiti, but none of these areas is so well collected that the absence of *olssoni* from collections can be taken as a demonstration of a real absence in the field. Except perhaps in the southwestern peninsula, the distribution can be interpreted better in terms of present ecology than in terms of any other factor. We list all the verified localities<sup>1</sup> for the two species below:

**SEMILINEATUS. HAITI:** *Dept. du Nord*, Cap Haitien (MCZ, USNM), Citadelle (MCZ), Dondon (MCZ); *Dept. de l'Artibonite*, Gros Morne (MCZ), San Michel (USNM); *Dept. de Ouest*, Basin Bleu nr Furey (MCZ), Bontillier Road nr Port-au-Prince (MCZ), 5 km south of Dufort, south of Leogane (MCZ), Furey (MCZ, AMNH), Obleon nr Furey (MCZ); *Département du Sud*, Miragoane (MCZ), Les Platons north of Aux Cayes (MCZ), Place Negre near Jeremie (MCZ). **DOMINICAN REPUBLIC:** *Prov. San Rafael*, Rancho La Guardia (MCZ); *Prov. Barahona*, Barahona (AMNH, Senckenberg), Palo (AMNH); *Prov. Benefactor*, 7 km north of Carpintero (MCZ); *Prov. Santiago Rodriguez*, Moncion (Senckenberg); *Prov. Santiago*, top of pass between Santiago and Puerto Plata (Senckenberg); *Prov. Puerto Plata*, 8 km north of Peña (MCZ), Balneario Colon, Puerto Plata (Senckenberg), Rio Munoz, 7 km from Puerto Plata (Senckenberg); *Prov. La Vega*, Jarabacoa (Senckenberg); *Prov. Espaillat*, Moca (Senckenberg), Rio San Juan (USNM); *Prov. Duarte*, Las Bracitas (AMNH); *Prov. Trujillo*, nr San Cristobal (MCZ); *Prov. San Pedro de Macoris*, San Pedro de Macoris (Senckenberg); *Prov. Seibo*, Boca del Inferno (USNM); San Francisco, 6 km east of Hato Mayor (MCZ); Rio Yabon

<sup>1</sup> The record of *semilineatus* for the island of Navassa is doubtful. A paratype of *A. olssoni* was recorded by Schmidt (1919) as probably from this island. In 1921 Schmidt redetermined the specimen as *A. semilineatus* and cited the species without qualification as a member of the Navassa fauna. No additional specimens of *A. semilineatus* have been collected, and the record is unconfirmed.



(MCZ); *Prov. Samana*, Laguna (AMNH), Samana (MCZ, Senckenberg), Sanchez (MCZ); *Distrito de Santo Domingo*, Ciudad Trujillo (Senckenberg).

OLSSONI. **HAITI:** *Dept. du Nord Ouest*, Bombardopolis (MCZ), Jean Rabel (MCZ, AMNH), Môle St. Nicolas (MCZ); *Dept. du Nord*, Cap Haitien (USNM); *Dept. de l'Artibonite*, bridge over the Artibonite (MCZ), south end of Etang Bois Neuf (MCZ), Gros Morne (MCZ), St. Marc (USNM, AMNH); *Department de Ouest*, Boutillier Road nr Port-au-Prince (MCZ), Carrefour (AMNH, Yale, UF), Cabrite Id (AMNH), Damien (MCZ), Delmas (MCZ), Diquini (MCZ, USNM), Eau Gaillee (Yale, UF), Etang Saumatre (MCZ), Fond Parisien (AMNH), Hatte Latham (MCZ, USNM), Manneville (MCZ), Mon Repos (USNM), Morne Decayette (MCZ), Petionville (Yale, UF), Port-au-Prince (MCZ, USNM, AMNH, Yale, UF), Ste. Philomene (USNM), Thomazeau (MCZ), between Thomazeau and Manneville (MCZ), Trou Caiman (USNM), Trou Forban (MCZ), *Gonave Id*, Anse a Galets (MCZ), Encafe (MCZ, USNM, Yale), Pointe-a-Raquettes (Yale, UF). **DOMINICAN REPUBLIC:** *Prov. Monte Cristi*, Monte Cristi (AMNH, Senckenberg); *Prov. San Rafael*, Banica (MCZ); *Prov. Independencia*, Las Baitoas (AMNH), Duverge (AMNH); *Prov. Barahona*, Barahona (AMNH), Senckenberg), Cabral (MCZ); *Prov. Santiago Rodriguez*, Moneion (Senckenberg); *Prov. El Seibo*, Sabana de la Mar (Senckenberg); *Distrito de Santo Domingo*: Ciudad Trujillo (Senckenberg).

A THIRD SPECIES DISCOVERED: On September 7 to 8, 1958, collecting in the vicinity of Constanza in the high interior of the Dominican Republic, C. E. Ray and A. S. Rand of Harvard University and Sr. Eugenio de Jesus Marcano of the Universidad de Santo Domingo obtained 20 specimens of a new species of "grass anole." The greater number of these specimens were collected at night, sleeping on grass stems. A renewed effort to collect the same form the next morning obtained very few individuals, the lizards being then very wary and difficult to see or catch.

Examination of these specimens reveals that they differ from the two previously known species in just the ways cited by Doris Cochran (1941, pp. 139-140) for a single specimen from Constanza which she then referred hesitantly to *A. olssoni*. Her remarks are quoted in full:

“With some doubt I place with *Anolis olssoni* a single adult male (USNM No. 62103) collected by Dr. W. L. Abbott in the hills 5 miles south of Constanza. This individual has much smaller scales on the gular fan than does typical *olssoni* from San Michel, Haiti. It does not approach, however, *semilineatus* in fineness of scales. In fact, while the gular scales are finer, the dorsal and ventral scales of the Constanza lizard are actually perceptibly coarser than they are in the San Michel specimens. The color pattern of this Constanza specimen shows none of the definite black markings that so often appear on true *olssoni*. It is lilac gray above, tinged with china-blue on the supraocular region, the dorsal tone shades into drab above the lateral light stripe, which is very sharply marked anteriorly but less so after it passes the shoulder, back of which it fades out almost completely. The only definite head marking is a black diagonal bar across the temporal region which does not occur in *olssoni* but is found in every specimen of *semilineatus*. A series of examples from Constanza will be needed to determine whether these characters are stable and definite, meriting specific separation or whether they represent an aberrant or hybridized *olssoni* with some of the *semilineatus* characters.”

Dr. Cochran has excellently characterized the new species, which may therefore be appropriately named:

#### ANOLIS COCHRANAE new species

*Type.* MCZ 57660, an adult ♂ collected at Constanza, Dominican Republic, September 7-8, 1958 by C. E. Ray, A. S. Rand, E. de Jesus Marciano.

*Paratypes.* MCZ 57661-79, same data as above: USNM 62103, hills 5 miles south of Constanza, collected by Dr. W. L. Abbott, April 29, 1919.

*Diagnosis.* An *Anolis* allied to *semilineatus* and *olssoni*, differing from the first in the much larger dorsal, ventral and supratemporal scales, from the latter in having a white rather than a red or orange dewlap in the somewhat larger dorsals and in having the gular scales little if at all larger than the ventrals, differing from both in having the ventrals nearly as large as the enlarged dorsals.

*Description.* *Head:* All head scales multicarinate rather than smooth or singly keeled. Five to eight scales across head between second and third canthals (usually six to seven). Frontal depression very shallow, the scales in it nearly or as large as the posterior frontal or anterior supraorbital.

Supraorbital semicircles in contact (five specimens) or separated by one scale row (fifteen specimens), wholly or partly separated by one scale row from the supraocular discs. Supraocular disc consisting of two to five large keeled scales separated from the elongate supraciliaries by at least two rows of scales. Canthus distinct, canthal scales four (five in one specimen), the second largest diminishing gradually forward. Naris anterior to canthal row. The anterior nasal scale in contact with rostral. Loreal rows four to five (three on both sides in one specimen). Temporal scales subgranular. Supratemporal scales larger, keeled, grading into the large keeled scales surrounding the interparietal. Interparietal larger than ear, separated from the supraorbital semicircles by one to three scales (usually two).

Posterior frontal as large as anterior supraorbital. One scale nearly as large as the posterior frontal between the latter and the canthals.

Suboculars in contact with supralabials. One scale intervening between subocular series and canthals. Five to six (six on one side, seven on the other in one specimen) supralabials to the center of the eye.

Mentals wider than long, one to two scales inserted between the tips posteriorly. One sublabial on each side in contact with the infralabials. Central throat scales keeled, elongate. Gular fan in males.

*Trunk*: About ten longitudinal rows of much enlarged keeled middorsal scales, broader than long, as large as the ventrals (10 to 12 in standard distance), grading laterally into the smaller flank scales which in some specimens are keeled imbricate, in others nearly granular. Ventrals in longitudinal rows, keeled, imbricate, mucronate. Postanal plates present in males. Scales of gular fan moderate, not extremely elongate, hardly larger than ventrals, not clearly arranged in lines.

*Limbs and digits*: Hand and foot scales multicarinate, about 17-19 lamellae under phalanges 2 and 3 of fourth toe, about 26-31 under whole toe. Largest arm and leg scales unicarinate, about as large as ventrals.

*Tail*: Tail subcircular in section, very long, more than  $2\frac{1}{2}$  times snout-vent length; verticils not apparent.

*Size*: Largest ♂ 41 mm in snout-vent length; largest ♀ 38 mm snout-vent length.



*Color*: Essentially as in *semilineatus*.

The more significant characters of *cochranae* may be compared with those of *semilineatus* and *olssoni* in tabular form:

<i>semilineatus</i>	<i>olssoni</i>	<i>cochranae</i>
skin of gular fan white	skin of gular fan orange to red	skin of gular fan white
flank stripe short	flank stripe long	flank stripe short
gular scales ea. = ventrals	gular scales >> ventrals	gular scales ea. = ventrals
14-17 enlarged dorsal scales in distance snout to middle of eye (standard distance)	11-13 enlarged dorsal scales in standard distance	10-12 enlarged dorsal scales in standard distance
median rows of enlarged dorsal scales about as broad as long	median rows of enlarged dorsal scales mostly longer than broad	median rows of enlarged dorsal scales about as broad as long
17-21 ventrals in standard distance	11-14 ventrals in standard distance	11-14 ventrals in standard distance

Other differences have been listed by Mertens or Cochran, but they are at best modal differences or they alter markedly with age. These species are indeed close, and females and juveniles are sometimes difficult to distinguish.

DISCUSSION: *Anolis cochranae* combines in new ways characters of *A. semilineatus* and *A. olssoni*. It is in no sense an intermediate; its characters are either those of one or the other or are somewhat exaggerated versions of a trend present in one.

It is necessary to admit that we know very little about this species beyond its existence. Its distribution would appear, on present evidence, to be extraordinarily limited. It may well be confined to the high interior, but its real range is surely more extensive than known at present. The area from which it comes is remarkable for certain peculiar forms: *Celestus darlingtoni* and *Audantia shrevei* in the higher elevations, *Anolis aliniger* (described as a subspecies of *A. chlorocyanus* by Mertens in 1939 but in reality a full species) in the vicinity of Constanza itself, *Anolis darlingtoni* both from Constanza and from higher elevations. The region merits extensive and systematic collecting.

The biological relation of *A. cochranae* to the other two members of the *semilineatus* group is equally unknown. We do not

know its contacts with either form. Its relationship to *A. semilineatus* in particular is puzzling. In squamation it differs strongly enough that we have called it, as a matter of judgment, a distinct species. The scale differences from both *semilineatus* and *olssoni* are as great or greater than the differences between other closely related sympatric fully valid species. But in other *Anolis* such (or lesser) differences are correlated with color and dewlap differences that are evident visual cues to species recognition. In color and dewlap *A. cochranæ* exactly resembles one of the neighboring species — *semilineatus*. If *A. cochranæ* is indeed a full species that is at some point in contact with *semilineatus*, it is necessary to suppose that there is some unknown behavioral difference that maintains the distinctness of the population in the absence of color cues.

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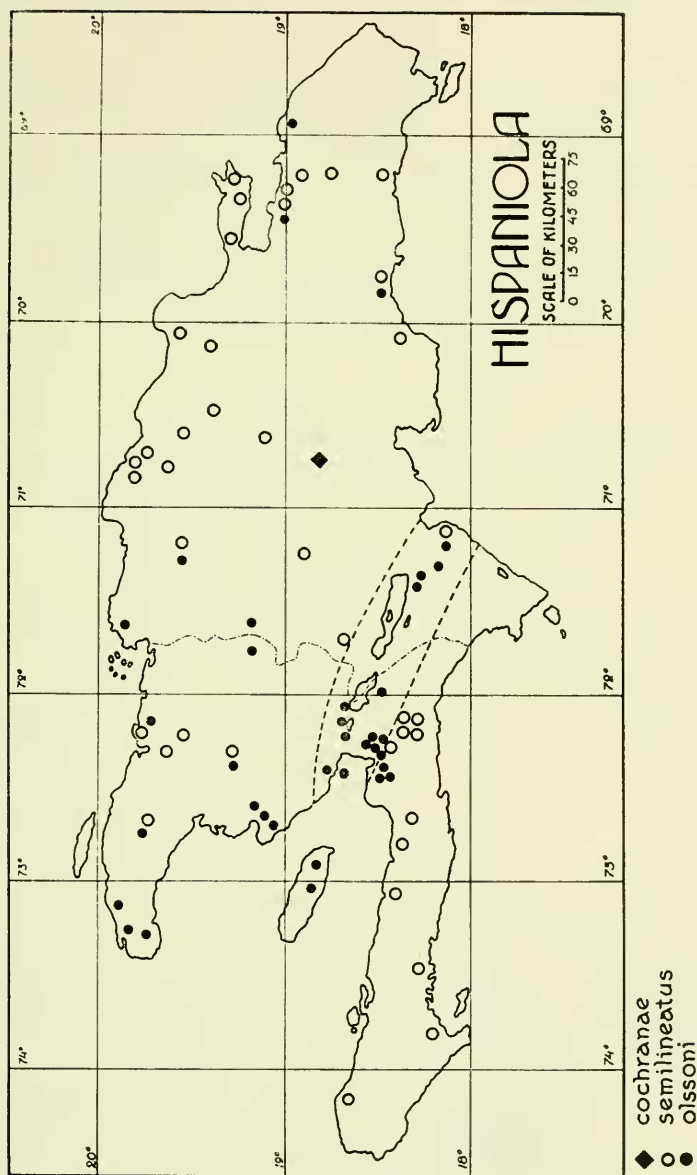
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Map: Distribution of the three species of the *Anolis semilineatus* group in Hispaniola.